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Practitioner's Docket No. 51048-2 *PATENT*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Goela et al.

Serial No.:	09/870,242	Group No.:	1772
Filed:	May 30, 2001	Examiner:	Walter Aughenbaugh
For:	METHOD AND APPARATUS FOR PRODUCING FREE-STANDING SILICON CARBIDE ARTICLES		

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF
In Response to Non-Compliant Appeal Brief

(PATENT APPLICATION--37 C.F.R. SECTION 1.192)

1. Transmitted herewith, in triplicate, is a new APPEAL BRIEF in response to Notification of Non-Compliant Appeal Brief dated April 20, 2006.

NOTE: "Appellant must, within two months from the date of the notice of appeal under section 1.191 or within the time allowed for reply to the action from which the appeal was taken, if such time is later, file a brief in triplicate....." 37 C.F.R. Section 1.192(a) (emphasis added)

2. STATUS OF APPLICANT

This application is on behalf of

[X] other than a small entity.
[ ] a small entity.

CERTIFICATE OF MAILING/TRANSMISSION (37 C.F.R. 1.8(a))

I hereby certify that, on the date shown below, this correspondence is being:

MAILING

[X] deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

FACSIMILE

[ ] transmitted by facsimile to the Patent and Trademark Office.

Date: 5/18/2006

Deanna Riverider
Signature

Deanna M. Rivernider
(*type or print name of person certifying*)

A statement:
[ ] is attached.
[ ] was already filed.

3. FEE FOR FILING APPEAL BRIEF

Pursuant to 37 C.F.R. Section 1.17(c), the fee for filing the Appeal Brief is:

[ ] small entity $250.00

[X] other than a small entity $500.00

Appeal Brief fee due $ 0.00*

***Appeal Brief fee previously authorized to be charged to Deposit Account 18-1850 with Appeal Brief filed February 17, 2006.**

4. EXTENSION OF TERM

NOTE: The time periods set forth in 37 C.F.R. 1.192(a) are subject to the provision of Section 1.136 for patent applications. 37 C.F.R. 1.191(d). See also Notice of November 5, 1985 (1060 O.G. 27).

NOTE: As the two-month period set in Section 1.192(a) for filing an appeal brief is not subject to the six-month maximum period specified in 35 U.S.C. 133, the period for filing an appeal brief may be extended up to seven months. 62 Fed. Reg. 53,131, at 53,156; 1203 O.G. 63 at 84. Oct. 10, 1997.

The proceedings herein are for a patent application and the provisions of 37 C.F.R. Section 1.136 apply.

(complete (a) or (b), as applicable)

(a) [ ] Applicant petitions for an extension of time under 37 C.F.R. Section 1.136 (fees: 37 C.F.R. Section 1.17(a)(1)-(5)) for the total number of months checked below:

	Extension (months)	Fee for other than small entity	Fee for small entity
[ ]	one month	$110.00	$55.00
[ ]	two months	$420.00	$210.00
[ ]	three months	$950.00	$475.00

Fee: $__________

If an additional extension of time is required, please consider this a petition therefor.

(check and complete the next item, if applicable)

[ ] An extension for _____ months has already been secured, and the fee paid therefor of $ _______ is deducted from the total fee due for the total months of extension now requested.

Extension fee due with this request $__________

or

(b) [X] Applicant believes that no extension of term is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

5. TOTAL FEE DUE

The total fee due is:

Appeal brief fee $ 500.00

Extension fee (if any) $ ______

TOTAL FEE DUE $ 0.00

6. FEE PAYMENT

[ ] Attached is a check in the sum of $ ____.
[ ] Charge Account No.______the sum of $______.

A duplicate of this transmittal is attached.

7. FEE DEFICIENCY

[X] If any additional extension and/or fee is required, this is a request therefor and to charge Account No. 18-1850 .

AND/OR

[X] If any additional fee for claims is required, charge Account No. 18-1850 .

Respectfully submitted,

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

51048-2

In re application of:
Goela et al. :

Serial No.: 09/870,242 :

Filed: May 30, 2001 : Group Art Unit: 1772

For: METHOD AND APPARATUS FOR PRODUCING FREE-STANDING SILICON CARBIDE ARTICLES : Examiner: Walter Aughenbaugh

Commissioner for Patents
P.O. BOX 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Dear Sir:

Applicants respectfully appeal the decision of the Examiner, mailed October 7, 2005, finally rejecting claims 27-30 and 32-37.

This brief is being filed in triplicate. This brief is a new Appeal Brief in response to non-compliance with 37 CFR 41.37(c)(1)(v) and 37 CFR 41.37(c)(1)(vii).

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is CVD, Inc. the assignee of the application, a wholly owned subsidiary of Rohm and Haas Company.

II. RELATED APPEALS AND INTERFERENCES

To the knowledge of the undersigned, there are no current appeals or interferences that will directly affect, or be directly affected by, or have a bearing on the Board's decision in this appeal.

III. STATUS OF THE CLAIMS

Claims 27-37 have been presented in this application.

Claim 31 was cancelled during prosecution.

Claims 27-30 and 32-37 are presently on appeal (see the attached Claim Appendix).

IV. STATUS OF AMENDMENTS (AFTER FINAL REJECTION)

No amendments have been filed since the mailing of the final rejection on October 7, 2005.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

Appellant's invention is directed to hollow chemical vapor deposited monolithic silicon carbide shells having an external perimeter of 50 inches or greater and an aspect ratio of 50 or greater (Claim 27 and specification at page 3, lines 9-12, and page 14, lines 19-23). Applicants invention also is directed to a hollow chemical vapor deposited monolithic silicon carbide shell having an external perimeter of 50 inches or greater, an aspect ratio of 50 or greater and without propagating cracks (Claim 37, and specification at page 3, lines 9-12, page 4, lines 20-25 and lines 29-33 and page 14, lines 19-23).

Prior to Appellant's invention hollow chemical vapor deposited monolithic silicon carbide shells would typically form propagating cracks when they were removed from mandrels on which they were deposited. The silicon carbide deposit would typically deposit onto the mandrel and extend to adjacent parts of the chemical vapor deposition chamber. In order to remove the mandrel with the silicon carbide deposit from the chamber, portions of the silicon carbide deposit extending to the adjacent parts of the chamber would be fractured. This would often result in cracks propagating throughout the silicon carbide deposit on the mandrel resulting in silicon carbide deposits unsuitable for parts for X-ray telescopes, semiconductor processing furnaces, heat exchangers, laser tubes and chemical process equipment. The prevalence of the propagated cracks limited the size of chemical vapor deposited silicon carbide shells that could be commercially produced. See specification at page 1, lines 21-23 and page 3, lines 14-32.

Appellant's invention also is directed to a hollow chemical vapor deposited monolithic silicon carbide shell (page 1, lines 15-21 and page 3, lines 9-12) made by providing a silicon carbide precursor gas (page 12, lines 24-30) in proximity to a surface of a solid substrate or mandrel 40 and 42 (page 5, lines 1-6, page 6, lines 18-19 and lines 30-31, page 7, line 33 to page 8, lines 1-2, Figure 1, Figure 2 and Figure 3) and an isolation device 50, 52, 54, 64 and 66 (page 7, lines 24-29, page 9, lines 8-12 and lines 21-24 and page 10, lines 14-19, Figure 1, Figure 2, Figure 3 and Figure 4) adjacent the solid substrate or mandrel 42 (page 7, lines 24-25, page 9, lines 21-26, Figure 1, Figure 2 and Figure 3) on a rotating platform 28 (page 6, lines 30-31, page 7, lines 24-25, Figure 1, Figure 2 and Figure 3) in a chemical vapor deposition chamber 10 (page 6, lines 3-5, Figure 1). The precursor gases enter the chamber by way of the gas injectors 38

(page 6, lines 14-16, Figure 1). The solid substrate and the isolation device are separated by a boundary zone 60 (page 8, lines 12-20, Figure 2). The rotating platform 28 is rotated 36 with the solid substrate and isolation device (page 6, lines 11-14, page 7, lines 3-6, page 8, lines 26-30, page 13, lines 26-28 and Figure 1). Silicon carbide precursor gases are reacted during rotation to provide a silicon carbide deposit on the solid substrate 42 and on the outer wall portion 52 of the isolation device 50 such that the silicon carbide deposit does not bridge the boundary zone 60 between the solid substrate and the outer wall 52 of the isolation device (page 2, lines 23-27, page 8, lines 12-24 and Figure 2). The open channel 58 defines the boundary zone 60 on that portion of the surface of the solid substrate which lies adjacent the open channel, i.e. that portion of the solid substrate extending beneath the outer wall portion 52 of the isolation device 50 (Figure 2). The absence of bridging permits removal of the mandrel with the silicon carbide deposit from the isolation device without the formation of propagating cracks (page 8, line 32 to page 9, line 3). The resulting deposit of silicon carbide is a hollow chemical vapor deposited monolithic silicon carbide shell without propagating cracks having an external perimeter of 50 inches or greater and an aspect ratio of 50 or greater (Claim 35, page 4, lines 24-29 and page 14, lines 19-23).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Whether claims 27-29 and 32-34 would have been obvious under 35 U.S.C. §103(a) over U.S. 5,783,255 to Suda et al.

2. Whether claim 30 would have been obvious under 35 U.S.C. §103(a) over U.S. 5,783,255 to Suda et al. in view of U.S. 5,776,391 to Sibley.

3. Whether claim 35 would have been obvious under 35 U.S.C. §103(a) over U.S. 5,783,255 to Suda et al.

4. Whether claims 36 and 37 would have obvious under 35 U.S.C. §103(a) over U.S. 5,783,255 to Suda et al.

VII. ARGUMENTS

ISSUE 1: Whether claims 27-29 and 32-34 would have been obvious under 35 U.S.C. §103(a) over U.S. 5,783,255 to Suda et al.

a) Claim 27

Claims 27-29 and 32-34 would not have been obvious under 35 U.S.C. §103(a) over U.S. 5,783,255 to Suda et al. The Examiner has not established a *prima facie* case of obviousness. A *prima facie* case of obviousness is established where the teachings of the applied documents suggest the claimed subject matter to persons of ordinary skill in the art. *In re Keller*, 208 U.S.P.Q. 876, 882 (C.C.P.A. 1981). Suda et al. (Suda) do not teach or suggest a hollow chemical vapor deposited monolithic silicon carbide shell having an external perimeter of 50 inches or greater and an aspect ratio of 50 or greater. The Office Action mailed July 29, 2004 at page 3, lines 1-4 admits that Suda teaches a "cylindrical SiC shell" with a diameter of 150mm (which correlates to an external perimeter of 18.5 inches). See Suda, column 6, lines 34-36. No where does Suda teach or even appear to suggest an external perimeter of 50 inches or greater as recited in present claim 1. Suda discloses an article having a much smaller external perimeter than that recited in present claim 1. The only other article described in Suda is a dome-shaped article with a diameter of only 50mm (col. 5, lines 22-25). No where does Suda provide any reason or motivation to make larger articles.

Moreover, Suda does not teach a "cylindrical SiC shell" with a diameter of 150mm. Suda teaches a disk-shaped silicon carbide article not a shell (col. 6, lines 33-34). A disk is not a shell. A shell has depth. In contrast a disk is flat. Appellant is not claiming a disk.

Further, a *prima facie* case of unpatentability is not established merely by speculation that claim limitations are "probably satisfied" by the applied documents. *In re Rijckaert*, 28 U.S.P.Q.2d 1955, 1957 (C.A.F.C. 1993). The Examiner is only speculating that the articles disclosed in Suda may be increased in size to the size of the articles recited in present claim 1. There is no teaching or suggestion in Suda that his articles could be increased in size to have an external perimeter of 50 inches or greater and an aspect ratio of 50 or greater. The Examiner alleges that increasing the size of a chemical vapor deposited silicon carbide article is generally recognized as being within the level of the person of ordinary skill in the art. The Examiner

cites *In re Rose*, 105 U.S.P.Q. 237 (C.C.P.A. 1955). However, the Examiner is in error. *In re Rose* is not applicable here. In the case *In re Rose*, the Appellant argued that the difference between their article (bundles of lumber tied together in a package) and the article (package of lumber) in the applied document (Wheless and Denison) was that Appellant's article was of appreciable size and weight to require handling by a lift truck. In contrast the article disclosed in the applied art could be carried by hand. The court concluded that this difference was not patentably significant because at most patentability related to the size of the article (see *In re Rose*, page 3, copy enclosed).

In contrast size of the silicon carbide articles alone is not the issue but the nature of the silicon carbide material from which the articles are made and the ability of silicon carbide to withstand cracks and flaws as it increases in size. Such issues were not addressed in *In re Rose*. Silicon carbide is a ceramic material. It is well established in the ceramics industry that as the size or volume of a chemical vapor deposited silicon carbide article increases the probability of the article to form cracks or flaws increases.

Appellant submitted a Rule 132 Declaration (copy enclosed) in response to the Office Action mailed April 20, 2005. The Declaration was made by a co-inventor of the present invention and describes the problems associated with increasing the size of ceramic materials such as chemical vapor deposited silicon carbide. The Declaration states that increasing the size of chemical vapor deposited silicon carbide during synthesis is not generally recognized as being within the level of the person of ordinary skill in the art. This is especially true when the volume of the chemical vapor deposited silicon carbide increases by a factor of 2 or more because as the size of the article increases the strength of the article decreases and stresses increase (see paragraph 7 of the Declaration).

Increasing the external perimeter of a chemical vapor deposited silicon carbide article having an external perimeter of 18.5 inches, as for the disk in Suda, to at least 50 inches, as recited in claim 27, would be increasing the size of the disk in Suda 2.7 times. A person of ordinary skill in the art would have expected that to increase the size of the disk-shaped article in Suda to the size of the silicon carbide articles recited in claim 27 would both decrease the strength of the article and increase stresses. This increases the probability of forming flaws in the silicon carbide (see paragraph 7 of the Declaration).

Chemical vapor deposited silicon carbide is a brittle material which is susceptible to flaw induced fracture. The strength of the silicon carbide depends on the size of the flaws and follows the Weibull distribution, i.e. variable m of stress equation $\sigma_2 = \sigma_{18} (A_{18}/A_2)^{1/m}$ (see paragraphs 8 and 17 of the Declaration). As the size of the silicon carbide article increases the probability of forming the flaws of increasing size also increase, thus the strength of the article decreases (see paragraph 9 of the Declaration). See enclosed article entitled "Applications of Chemical Vapor Deposited β-SiC", SPIE Proc. Vol. CR 67, 71-103 (July 1997).

Further, the Weibull distribution or modulus m for chemical vapor deposited silicon carbide is 4 (see paragraph 17 of Declaration and article "Applications of Chemical Vapor Deposited β-SiC"). Ceramic materials having a Weibull distribution of from 3-5 are expected to have inconsistent strengths over a range of different volumes (see page 43, first column, first complete paragraph of the ASM Handbook, volume 8, Mechanical Testing and Evaluation, copy enclosed). Accordingly, as the magnitude of the volume of a chemical vapor deposited silicon carbide article changes the strength of the article becomes more and more unpredictable.

There are two types of stresses involved in making chemical vapor deposited silicon carbide: 1. growth stresses and 2. stresses due to thermal expansion mismatch (see paragraph 11 of the Declaration). As the size of the chemical vapor deposited silicon carbide article increases both the growth stresses and the stresses caused by thermal mismatch increase (see paragraphs 9 and 10 of the Declaration). As the stresses increase the probability of flaws also increase (see paragraphs 9 and 10 of the Declaration). As pointed out in the Declaration in paragraph 14 Suda may have reduced the stresses due to thermal expansion mismatch between the silicon carbide and the carbon substrate on which it is deposited (col. 4, lines 55-58). However, as pointed out in the Declaration (paragraph 14), it is unlikely that the coefficient of thermal expansion (CTE) of the carbon substrate and the silicon carbide deposit match all temperatures during the cool down from 1400° C until the deposit is removed from the carbon substrate (col. 5, lines 9-26), thus growth stresses would still be expected to be present. As the size of the article increases the growth stresses would increase with decreasing strength of the article. As the article increases in size the size of any flaws would increase as well. Accordingly, increasing the size of a chemical vapor deposited silicon carbide article would not have been viewed as being within the level of the person of ordinary skill in the art (see paragraph 18 of the Declaration).

The Examiner's allegation that increasing the size of a ceramic material such as chemical vapor deposited silicon carbide would have been within the level of the person of ordinary skill in the art is based on subjective belief and unknown authority. The Examiner has not provided any objective evidence to show that increasing the size of a silicon carbide article would have been within the level of the person of ordinary skill in the art. The Examiner is obligated to provide such a document. *In re Lee*, 61 U.S.P.Q.2d 1430 (C.A.F.C. 2002). In contrast, the Appellant has shown that it would not have been within the level of skill in the art to merely increase the size of a chemical vapor deposited silicon carbide article without forming cracks or flaws. The combination of Suda with the knowledge of the problems associated with sizing chemical vapor deposited silicon carbide articles teaches away from Appellant's claimed invention. Accordingly, claim 27 is patentable over Suda.

b) Claim 28

The Examiner has failed to present a *prima facie* case of obviousness. Suda does not teach or suggest that its silicon carbide articles may be increased in size to an external perimeter of 50 inches or greater and an aspect ratio of 50 or greater and have a cylindrical shape. *In re Keller*, 208 U.S.P.Q. at 882. The Examiner is only speculating that the claim limitations are "probably satisfied" by Suda and a *prima facie* case of obviousness is not established by mere speculation. *In re Rijckaert*, 28 U.S.P.Q.2d at 1957. Suda only discloses a silicon carbide disk-shaped article having a diameter of 150mm (col. 6, lines 33-34) and a dome-shaped article having a diameter of 50mm (col. 5, lines 22-25). There is no teaching or suggestion of how to increase the size of the articles to the size of the presently claimed articles without forming cracks or flaws.

Further, it is well settled in the ceramics industry that increasing the size of a chemical vapor deposited silicon carbide article is not within the level of the person of ordinary skill in the art (see Rule 132 Declaration, "Application of Chemical Vapor Deposited β-SiC", SPIE Proc. Vol. CR67, 71-103 (July 1997) and ASM Handbook, Volume 8, Mechanical Testing and Evaluation). Suda in combination with the level of skill of the person of ordinary skill in the art teaches away from claim 28 because as the article is increased in size the potential for flaws is also increased.

The Examiner has not provided any objective evidence to show that increasing the size of a chemical vapor deposited silicon carbide article would have been within the level of the person of ordinary skill in the art at the time the presently claimed invention was made. The Examiner is obligated to provide such evidence. *In re Lee*, 61 U.S.P.Q.2d at 1430. Accordingly, claim 28 is patentable over Suda.

c) Claim 29

The Examiner has failed to present a *prima facie* case of obviousness. Suda does not teach or suggest that its silicon carbide articles may be increased in size to an external perimeter of 50 inches or greater and an aspect ratio of 50 or greater and have a frustoconical shape. *In re Keller*, 208 U.S.P.Q. at 882. The Examiner is only speculating that the claim limitations are "probably satisfied" by Suda and a *prima facie* case of obviousness is not established by mere speculation. *In re Rijckaert*, 28 U.S.P.Q.2d at 1957. Suda only discloses a silicon carbide disk-shaped article having a diameter of 150mm (col. 6, lines 33-34) and a dome-shaped article having a diameter of 50mm (col. 5, lines 22-25). There is no teaching or suggestion of how to increase the size of the article to the size of the presently claimed articles.

It is well established in the ceramics industry that increasing the size of a chemical vapor deposited silicon carbide article is not within the level of the person of ordinary skill in the art (see Rule 132 Declaration, "Application of Chemical Vapor Deposited β-SiC", SPIE Proc. Vol. CR67, 71-103 (July 1997) and ASM Handbook, Volume 8, Mechanical Testing and Evaluation). Suda in combination with the knowledge of the difficulties of sizing chemical vapor deposited silicon carbide teaches away from claim 29 because as the size of the article is increased its potential for forming flaws is also increased.

The Examiner has not provided any objective evidence to show that increasing the size of a chemical vapor deposited silicon carbide article would have been within the level of the person of ordinary skill in the art at the time the presently claimed invention was made. The Examiner is obligated to provide such evidence. *In re Lee*, 61 U.S.P.Q.2d at 1430. Accordingly, claim 29 is patentable over Suda.

d) Claim 32

The Examiner has failed to present a *prima facie* case of obviousness. Suda does not teach or suggest that its silicon carbide articles may be increased in size to an external perimeter in

excess of 65 inches. *In re Keller*, 208 U.S.P.Q. at 882. As pointed out in the Office Action mailed July 29, 2004 at page 3, lines 1-4 Suda teaches a silicon carbide disk-shaped article having an external perimeter of only 18.5 inches. Suda does not teach or suggest an external perimeter any larger than 18.5 inches. The external perimeter of the hollow silicon carbide shell of claim 32 far exceeds that of the article disclosed in Suda. The Examiner is only speculating that the claim limitations are "probably satisfied" by Suda and a *prima facie* case of obviousness is not established by mere speculation. *In re Rijckaert*, 28 U.S.P.Q.2d at 1957. There is no teaching or suggestion of how to increase the size of the article disclosed in Suda to that of the article recited in claim 32 without the formation of cracks and flaws.

It is well settled in the ceramics industry that increasing the size of a chemical vapor deposited silicon carbide article is not within the level of the person of ordinary skill in the art (see Rule 132 Declaration, "Application of Chemical Vapor Deposited β-SiC", SPIE Proc. Vol. CR67, 71-103 (July 1997) and ASM Handbook, Volume 8, Mechanical Testing and Evaluation). Suda in combination with the knowledge of the difficulties of sizing chemical vapor deposited silicon carbide in the art teaches away from claim 32. As the size of the silicon carbide article increases the probability of flaws forming also increases.

The Examiner has not provided any objective evidence to show that increasing the size of a chemical vapor deposited silicon carbide article would have been within the level of the person of ordinary skill in the art at the time the presently claimed invention was made. The Examiner is obligated to provide such evidence. *In re Lee*, 61 U.S.P.Q.2d at 1430. Accordingly, claim 32 is patentable over Suda.

e) Claim 33

The Examiner has failed to present a *prima facie* case of obviousness. Suda does not teach or suggest that its silicon carbide articles may be increased in size to an external perimeter of 50 inches or greater and an aspect ratio of 200 or greater. *In reKeller*, 208 U.S.P.Q. at 882. The largest external perimeter for the articles disclosed in Suda is only 18.5 inches. Suda does not provide any teaching or suggestion for chemical vapor deposited silicon carbide articles of larger external perimeter. The Examiner is only speculating that the claim limitations are "probably satisfied" by Suda and a *prima facie* case of obviousness is not established by mere speculation. *In re Rijckaert*, 28 U.S.P.Q.2d at 1957.

It is well settled in the ceramics industry that increasing the size of a chemical vapor deposited silicon carbide article is not within the level of the person of ordinary skill in the art. (see Rule 132 Declaration, "Application of Chemical Vapor Deposited β-SiC", SPIE Proc. Vol. CR67, 71-103 (July 1997) and ASM Handbook, volume 8, Mechanical Testing and Evaluation). The combination of Suda with the knowledge in the art of the problems of sizing ceramics teaches away from the subject matter of claim 33.

Further, the Examiner has not provided any objective evidence to show that increasing the size of a chemical vapor deposited silicon carbide article would have been within the level of the person of ordinary skill in the art at the time the presently claimed invention was made. The Examiner is obligated to provide such evidence. *In re Lee* 61 U.S.P.Q.2d at 1430. Accordingly, claim 33 is patentable over Suda.

f) <u>Claim 34</u>

The Examiner has failed to present a *prima facie* case of obviousness. Suda does not teach or suggest that the silicon carbide articles it discloses may be increased in size to an external perimeter of 50 inches with an aspect ratio of 100 or greater. *In re Keller*, 208 U.S.P.Q. at 882. The Examiner is only speculating that the claim limitations are "probably satisfied" by Suda and a *prima facie* case of obviousness is not established by mere speculation. *In re Rijckaert*, 28 U.S.P.Q.2d at 1957. No where does Suda provide any teaching or suggestion of how to increase the size of the article to the size of the presently claimed articles.

It is well settled that increasing the size of a chemical vapor deposited silicon carbide article is not within the level of the person of ordinary skill in the art (See Rule 132 Declaration, "Application of Chemical Vapor Deposited β-SiC", SPIE Proc. Vol. CR67, 71-103 (July 1997) and ASM Handbook, volume 8, Mechanical Testing and Evaluation). Suda in combination with the knowledge of the difficulties of sizing chemical vapor deposited silicon carbide articles teaches away from increasing the size of the articles in Suda because as the size of the article increases the potential for flaws to form in the article also is increased.

The Examiner has not provided any objective evidence to show that increasing the size of a chemical vapor deposited silicon carbide article would have been within the level of the person of ordinary skill in the art when the presently claimed invention was made. The Examiner is

obligated to provide such evidence. *In re Lee*, 61 U.S.P.Q.2d at 1430. Accordingly, claim 34 is patentable over Suda.

ISSUE 2: Whether claim 30 would have been obvious under 35 U.S.C. §103(a) over U.S. 5,783,255 to Suda et al. in view of U.S. 5,776,391 to Sibley.

Claim 30 would not have been obvious under 35 U.S.C. §103(a) over U.S. 5,783,255 to Suda et al. alone or in combination with U.S. 5,776,391 to Sibley. The Examiner has not presented a *prima facie* case of obviousness in view of Suda et al. (Suda) alone or in combination with Sibley. A *prima facie* case of obviousness is established where teachings of the applied documents suggest the claimed subject matter to persons of ordinary skill in the art. *In re Keller*, 208 U.S.P.Q. 876, 882 (C.C.P.A. 1981). Suda do not teach or suggest a hollow chemical vapor deposited monolithic silicon carbide shell having an external perimeter of 50 inches or greater and an aspect ratio of 50 or more and a density of at least 3.15 grams per centimeter. No where does Suda teach or suggest silicon carbide articles having such large dimensions as external perimeter and aspect ratio and at the same time having a density of at least 3.15 grams per centimeter. The largest article disclosed in Suda has a diameter of 150mm and an external perimeter of only 18.5 inches. The Examiner is only speculating that the claim limitations are "probably satisfied" by Suda and a *prima facie* case of obviousness is not established by mere speculation. *In re Rijckaert*, 28 U.S.P.Q.2d 1955, 1957 (C.A.F.C. 1993). There is no teaching or suggestion in Suda on how to increase the size of silicon carbide articles to the size as recited in claim 30.

It is well settled in the ceramics art that increasing the size of a chemical vapor deposited silicon carbide article is not within the level of the person of ordinary skill in the art (see Rule 132 Declaration, "Application of Chemical Vapor Deposited β-SiC", SPIE Proc. Vol. CR67, 71-103 (July 1997) and ASM Handbook, Volume 8, Mechanical Testing and Evaluation). The combination of Suda and the knowledge of the difficulties of sizing chemical vapor deposited silicon carbide articles teaches away from increasing the size of the articles disclosed in Suda because as the articles increase in size it is expected that flaws also will increase.

The Examiner has not provided any objective evidence to show that increasing the size of the silicon carbide articles of Suda to the size recited in claim 30 would have been within the

level of the person of ordinary skill in the art. The Examiner is obligated to provide such a document. *In re Lee*, 61 U.S.P.Q.2d 1430 (C.A.F.C. 2002).

Sibley does not make-up for the deficiencies of Suda. Sibley is totally silent on external perimeter and aspect ratio as recited in claim 30. Accordingly, claim 30 is patentable over Suda alone or in combination with Sibley.

ISSUE 3: Whether claim 35 would have been obvious under 35 U.S.C. §103(a) over U.S. 5,783,255 to Suda et al.

Claim 35 would not have been obvious under 35 U.S.C. §103(a) over U.S. 5,783,255 to Suda et al. (Suda). The Examiner has not established a *prima facie* case of obviousness. A *prima facie* case of obviousness is established where the teachings of the applied documents suggest the claimed subject matter to persons of ordinary skill in the art. *In re Keller*, 208 U.S.P.Q. 876, 882 (C.C.P.A. 1981). Suda does not teach or suggest a silicon carbide article with an external perimeter of 50 inches or greater and an aspect ratio of 50 or greater without propagating cracks. No where does Suda teach or suggest silicon carbide articles of such sizes. Further, Suda does not teach or suggest the steps of making such an article using a rotating platform and an isolation device with a boundry zone. Suda is totally silent on such a method. The Examiner is only speculating that the claim limitations are "probably satisfied" by Suda and a *prima facie* case of obviousness is not established by mere speculation. *In re Rijckaert*, 28 U.S.P.Q.2d at 1957.

It is well settled in the ceramics industry that increasing the size of a chemical vapor deposited silicon carbide article is not within the level of the person of ordinary skill in the art (see Rule 132 Declaration, "Application of Chemical Vapor Deposited β-SiC", SPIE Proc. Vol. CR67, 71-103 (July 1997) and ASM Handbook, Volume 8, Mechanical Testing and Evaluation). Suda in combination with the knowledge of the difficulties of sizing chemical vapor deposited silicon carbide articles teaches away from silicon carbide articles having the sizes recited in present claim 35.

The Examiner has not provided any objective evidence to show that increasing the size of the silicon carbide articles of Suda to the sizes recited in claim 35 would have been within the level of the person of ordinary skill in the art at the time the present invention was made. The

Examiner is obligated to provide such a document. *In re Lee*, 61 U.S.P.Q.2d 1430 (C.A.F.C. 2002).

Further, the Examiner's allegation that the method of making the silicon carbide articles of claim 35 is not germane in distinguishing claim 35 over Suda is in error. It is well settled that an applicant may present claims of varying scope even if it is necessary to describe the claimed product in product-by-process terms. See MPEP §2173.05(p) and *Ex parte Pantzer*, 176 U.S.P.Q. 141 (Bd. App. 1972). Further, the structure implied by the process steps should be considered when assessing the patentability of product-by-process claims over applied documents, especially where the product can only be defined by the process steps which the product is made, or where the manufacturing steps would be expected to impart distinctive structural characteristics to the final product. See MPEP §2113 and *In re Garnero*, 162 U.S.P.Q. 221, 223 (C.C.P.A. 1979). The manufacturing steps recited in claim 35 impart distinctive structural features on the hollow chemical vapor deposited monolithic silicon carbide shell. By depositing chemical vapor deposited silicon carbide on a solid substrate and an isolation device in a deposition chamber where the solid substrate and the isolation device are separated by a boundry zone, silicon carbide does not form a bridge of deposit joining the solid substrate to the isolation device. The solid substrate with the silicon carbide deposit may be removed from the deposition chamber without having to fracture the deposit, thus propagating cracks are prevented from forming in the deposit (see specification page 8, line 26 to page 9, line 6). Accordingly, the Examiner must give equal weight to the method steps as with all other elements in the claim.

Claim 35 is patentable over Suda for the reasons discussed above.

<u>ISSUE 4</u>: Whether claims 36 and 37 would have been obvious under 35 U.S.C. §103(a) over U.S. 5,783,255 to Suda et al.

a) <u>Claim 36</u>

The Examiner has not presented a *prima facie* case of obviousness. A *prima facie* case of obviousness is established where the teachings of the applied documents suggest the claimed subject matter to persons of ordinary skill in the art. *In re Keller*, 208 U.S.P.Q. 876, 882 (C.C.P.A. 1981). Suda do not teach or suggest a hollow chemical vapor deposited monolithic silicon carbide shell with an external perimeter of 50 inches or greater and an aspect ratio of 50

or greater and a diameter of 18 inches or greater. Suda only disclose a disk-shaped article of 150mm (col. 6, lines 33-35) or an external perimeter of 18.5 inches and a dome-shaped article with a diameter of 50mm (col. 5, lines 22-25). The Examiner is only speculating that the claimed limitations are "probably satisfied" by Suda, however, a *prima facie* case of obviousness is not established by speculation. *In re Rijckaeert*, 28 U.S.P.Q. 2d 1955, 1957 (C.A.F.C. 1993). Suda does not provide any teaching or suggestion of how to increase the size of a silicon carbide article to the dimensions recited in claim 36.

It is well settled that increasing the size of a chemical vapor deposited silicon carbide article is not within the level of the person of ordinary skill in the art (see Rule 132 Declaration, "Application of Chemical Vapor Deposited β-SiC", SPIE Proc. Vol. CR67, 71-103 (July 1997) and ASM Handbook, Volume 8, Mechanical Testing and Evaluation). Chemical vapor deposited silicon carbide is a brittle material which is susceptible to flaw induced fracture. The strength of the silicon carbide depends on the size of the flaws and follows the Weibull distribution (see paragraph 8 of the Declaration). As the size of the silicon carbide article increases the probability of forming flaws of increasing size also increases, thus the strength of the article decreases (see Paragraph 9 of Declaration). The Examiner has not provided any objective evidence to show that increasing the size of a silicon carbide article would have been within the level of the person of ordinary skill in the art. The Examiner is obligated to provide such a document. *In re Lee*, 61 U.S.P.Q.2d 1430 (C.A.F.C. 2002).

As shown in the Declaration to scale a chemical vapor deposited silicon carbide article having a diameter of 2 inches (50mm), such as the dome-shaped article disclosed in Suda, to one having a diameter increased to 18 inches, as recited in claim 36, results in a strength decrease in the article by a factor of about $3 = (A_{18}/A_2)^{1/m}$ as determined by the maximum allowable stress equation (see paragraph 17 of the Declaration and the Article "Application of Chemical Vapor Deposited β-SiC"). Accordingly, as the size of a 2 inch (50mm) silicon carbide dome-shaped article is increased to a size of 18 inches the strength of the article decreases by a factor of 3 and the probability of forming larger flaws in the article increases (see paragraph 9 of the Declaration).

Suda in combination with the knowledge of the difficulties of sizing silicon carbide materials teaches away from the present claim 36. A person of ordinary skill in the art would not

have been motivated to increase the size of the articles disclosed in Suda to the sizes recited in claim 36 because flaws would have been expected to form as shown by the stress equation in the enclosed Declaration. Accordingly, claim 36 is patentable over Suda.

b) Claim 37

The Examiner has not presented a *prima facie* case of obviousness. Suda does not teach or suggest that silicon carbide articles of Suda may be increased to an external perimeter of 50 inches or greater and an aspect ratio of 50 or greater without propagating cracks. *In re Keller*, 208 U.S.P.Q. at 882. The Examiner is only speculating that the claim limitations are "probably satisfied" by Suda, however, a *prima facie* case of obviousness is not established by mere speculation. *In re Rijckaert*, 28 U.S.P.Q.2d at 1957. As admitted by the Examiner the largest external perimeter of any article disclosed in Suda is only 18.5 inches. This is no where near the 50 inches or greater recited in claim 37.

Further, it is well settled that increasing the size of a chemical vapor deposited silicon carbide article is not within the level of the person of ordinary skill in the art as shown in the Declaration and the other two papers enclosed herein. A person of skill in the art following the disclosure in Suda in combination with the knowledge in the art of the difficulties associated with increasing the size of silicon carbide articles would have had no motivation to increase the size of the articles disclosed in Suda to the sizes recited in present claim 37. Accordingly, claim 37 is patentable over Suda.

SUMMARY

Therefore, for the foregoing reasons, it is respectfully submitted that the Board reverse the final rejection in this application.

Respectfully submitted,

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VIII. CLAIMS APPENDIX

27. A hollow chemical vapor deposited monolithic silicon carbide shell having an external perimeter of 50 inches or greater and an aspect ratio of 50 or greater.

28. The hollow chemical vapor deposited monolithic silicon carbide shell of claim 27 having a cylindrical shape.

29. The hollow chemical vapor deposited monolithic silicon carbide shell of claim 27 having a frustoconical shape.

30. The hollow chemical vapor deposited monolithic silicon carbide shell of claim 27, wherein the density of said chemical vapor deposited monolithic silicon carbide is at least 3.15 grams per cubic centimeter.

32. The hollow chemical vapor deposited monolithic silicon carbide shell of claim 27, wherein an external perimeter of said hollow shell is in excess of 65 inches.

33. The hollow chemical vapor deposited monolithic silicon carbide shell of claim 27, wherein said aspect ration is 200 or greater.

34. The hollow chemical vapor deposited monolithic silicon carbide shell of claim 27, wherein said aspect ratio is 100 or greater.

35. A hollow chemical vapor deposited monolithic silicon carbide shell made according to a process comprising:

a) providing a silicon carbide precursor gas in proximity to a surface of a solid substrate and an isolation device adjacent the solid substrate on a rotating platform in a deposition chamber, the solid substrate and the isolation device are separated by a boundary zone,
b) rotating the rotating platform with the solid substrate and isolation device,
c) reacting silicon carbide precursor gas during rotation to provide a silicon carbide deposit on the surface of the substrate and on the isolation device such that the silicon carbide deposit does not bridge the boundary zone between the solid and the isolation device, and
d) removing the silicon carbide deposit to provide a hollow chemical vapor deposited monolithic silicon carbide shell without propagating cracks having

an external perimeter of 50 inches or greater and an aspect ratio of 50 or greater.

36. The hollow chemical vapor deposited monolithic silicon carbide shell of claim 27, wherein a diameter of the shell is 18 inches or greater.

37. A hollow chemical vapor deposited monolithic silicon carbide shell having an external perimeter of 50 inches or greater, an aspect ratio of 50 or greater and without propagating cracks.

IX. EVIDENCE APPENDIX

The following documents were filed during the prosecution of the present patent application by the Appellant:

i. Rule 132 Declaration was submitted in response to the Office Action mailed April 20, 2005.

ii. *In re Rose*, 105 U.S.P.Q. 237 (C.C.P.A. 1955) was filed in response to the Office Action mailed April 20, 2005.

iii. Pickering et al., "Application of Chemical Vapor Deposited β-SiC", SPIE Proc. Vol. CR67, pp 71-103 was submitted in an Information Disclosure Statement filed with the response to the Office Action mailed September 24, 2004.

iv. ASM Handbook, "Mechanical Testing of Polymers and Ceramics, Volume 8, Mechanical Testing and Evaluation, pp. 41-43 (2000) was filed with an Information Disclosure Statement in response to the Office Action mailed September 24, 2004.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

51048-2 DIV

In re application of:
Goela et al. :

Serial No.: 09/870,242 :

Filed: May 30, 2001 : Group Art Unit: 1772

For: IMPROVED IMAGING COMPOSITIONS AND METHODS : Examiner: Walter Augenbaugh

DECLARATION UNDER 37 CFR §1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Dr. Jitendra S. Goela declares and says:

1) THAT he is a co-inventor of the above-identified patent application and is familiar with the present Office Action mailed April 20, 2005 as well as the previous Office Actions of the above-identified patent application and the applied documents U.S. 5,783,255 to Suda et al. and U.S. 5,776,391 to Sibley;
2) THAT he has been employed at Rohm and Haas Advanced Materials (formerly Morton Advanced Materials) for twenty-one (21) years and currently holds the position of Principle Scientist where he is managing several research and development programs in the area of infrared optical materials such as zinc selenide and zinc sulfide and ceramic materials such as silicon carbide;
3) THAT his work at Rohm and Haas Advanced Materials has involved work with silicon carbide involving the development of new chemical vapor deposited silicon carbide materials such as controlled resistivity silicon carbide, transparent silicon carbide, near-net shape silicon carbide and silicon carbide-silicon carbide bonding as well as

size scaling and commercialization of chemical vapor deposited silicon carbide technology for optics, semiconductor and wear applications;

4) THAT prior to joining Rohm and Haas Advanced Materials he was Assistant Professor for 4 years during 1980-84 and Lecturer for 2 years during 1978-1980 in the Department of Mechanical Engineering at I.I.T. Kanpur, India.

5) THAT prior to working at I.I.T. Kanpur, India, he worked at Physical Sciences Inc. in Andover, Massachusetts for 2 years during 1976-1978 as Principal Scientist where he conducted research and development in the areas of high power lasers and wind conversion;

6) THAT he received his Ph.D. in Engineering in fluids and thermodynamics from Brown University, Rhode Island in 1976 and a M.Sc. in Engineering in fluids and thermodynamics also from Brown University in 1974;

7) THAT increasing the size of ceramic materials such as chemical vapor deposited silicon carbide during synthesis is not generally recognized as being within the level of ordinary skill in the art especially when the volume of the chemical vapor deposited silicon carbide increases by a factor of 2 or more because as the size of the chemical vapor deposited silicon carbide article increases the strength of the article decreases and stresses increase;

8) THAT the chemical vapor deposited silicon carbide is a brittle material susceptible to flaw induced fracture and the strength depends upon the size of the surface flaws and follows the Weibull distribution as defined in Exhibit A;

9) THAT the larger the flaw size the lower is the strength of the chemical vapor deposited silicon carbide article and as the size of the chemical vapor deposited silicon carbide article increases the probability of forming flaws of increasing size also increases, thus the flexural strength (defined as the strength of a material in bending, expressed as the stress on the outermost surface of a bent test specimen, at the instant of failure) of the article decreases;

10) THAT in addition to the strength of the chemical vapor deposited silicon carbide article decreasing as the size of the article increases, stresses in the article increase;

11) THAT there are two dominant stress factors which occur during chemical vapor deposition of silicon carbide: a) growth stresses and b) stresses due to thermal expansion (CTE = coefficient of thermal expansion) mismatch between the chemical vapor deposited silicon carbide and the material composing the substrate on which the silicon carbide is deposited;

12) THAT the growth stresses and the stresses due to thermal expansion mismatch are a function of the size of the silicon carbide article, particularly the deposition thickness;

13) THAT as the size of the silicon carbide deposit increases, the deposition area increases and the variation in deposit thickness increases, thus both the growth stresses and the stresses due to thermal expansion mismatch increase;

14) THAT the method disclosed in Suda et al. may have tried to produce a substrate material that has CTE close to that of the Silicon Carbide. However, it is highly unlikely that the CTE of the substrate material matches at all temperatures during SiC cooldown from deposition temperature due to its large temperature range (1400C to room temperature). Thus although the stresses from CTE mismatch are reduced, growth stresses are still present during chemical vapor deposition of silicon carbide;

15) THAT the chemical vapor deposited silicon carbide article of the presently claimed invention has a diameter of 18 inches or greater;

16) THAT Suda et al. disclose a chemical vapor deposited dome having a diameter of 50mm = 2 inches;

17) THAT an area scaling from a diameter of 2 inches to 18 inches of a chemical vapor deposited silicon carbide article results in a strength decrease by a factor of about 3 as determined by the following equation for determining the strength of a chemical vapor deposited silicon carbide article as disclosed in Exhibit B:

$$\sigma_2 = \sigma_{18} (A_{18}/A_2)^{1/m}$$

where σ_2 and σ_{18} are the mean fracture stress for a 2-inch and 18-inch diameter parts, A_2 is the area of the 2-inch diameter part (3.1416-inch^2), A_{18} is the area of the 18-inch diameter part (254-inch^2), and m = 4, which is the Weibull modulus for chemical vapor deposited silicon carbide; and

18) THAT based on this calculation a skilled artisan would expect that increasing the size of the chemical vapor deposited silicon carbide dome disclosed in Suda et al. to a diameter of 18 inches or greater can result in a dome with propagating cracks and that techniques in addition to the CTE matched substrates would be required to produce a dome to a diameter of 18 inches or greater without propagating cracks.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Jitendra S. Goela

Dr. Jitendra S. Goela

Date: July 14, 2005

MAY.06'2004 18:05

Year 2000

Exhibit A

ASM HANDBOOK

Volume

8

Mechanical Testing and Evaluation

ASM INTERNATIONAL

The Materials Information Society

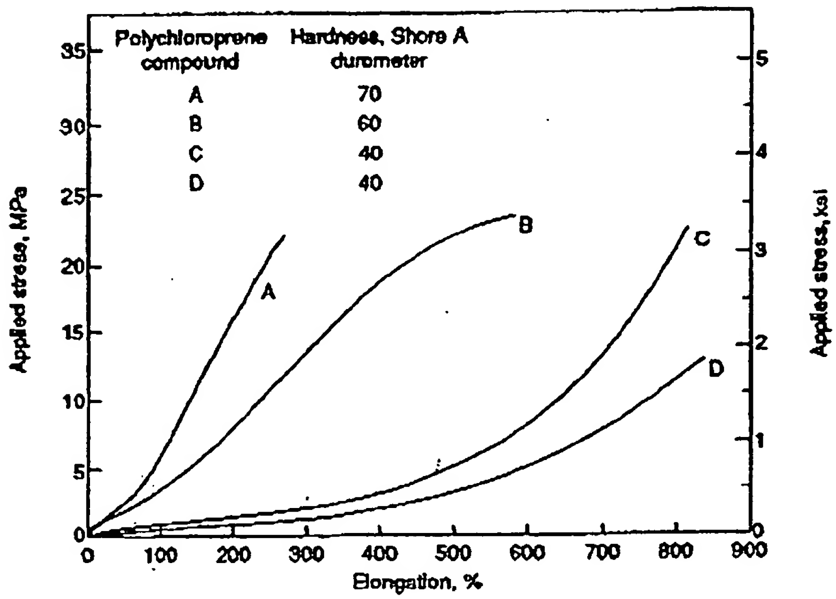

Fig. 25 Tensile-test curves for four polychloroprene compounds

chine. The filaments are then stressed to failure at a constant strain rate. For this test method, filament cross-sectional areas are determined by planimeter measurements of a representative number of filament cross sections as displayed on highly magnified micrographs. Alternative methods of area determination use optical gages, an image-splitting microscope, a linear weight-density method, and others.

Tensile strength and Young's modulus of elasticity are calculated from the load elongation records and the cross-sectional area measurements.

The specimen setup is shown in Fig. 26. Note that a system compliance adjustment may be necessary for single-filament tensile modulus.

Tow Tensile Test (ASTM D 4018). The strength of fibers is rarely determined by testing single filaments and obtaining a numerical average of their strength values. Usually, a bundle or yarn of such fibers is impregnated with a polymer and loaded to failure. The average fiber strength is then defined by the maximum load divided by the cross-sectional area of the fibers alone.

Using ASTM D 4018 or an equivalent is recommended. This is summarized as finding the tensile properties of continuous filament carbon and graphite yarns, strands, rovings, and tows by the tensile loading to failure of the resin-impregnated fiber forms. This technique loses accuracy as the filament count increases. Strain and Young's modulus are measured by extensometer.

The purpose of using impregnating resin is to provide the fiber forms, when cured, with enough mechanical strength to produce a rigid test specimen capable of sustaining uniform loading of the individual filaments in the specimen.

To minimize the effect of the impregnating resin on the tensile properties of the fiber forms, the resin should be compatible with the fiber, the resin content in the cured specimen should be limited to the minimum amount required to produce a useful test specimen, the individual filaments of the fiber forms should be well collimated, and the strain capability of the resin should be significantly greater than the strain capability of the filaments.

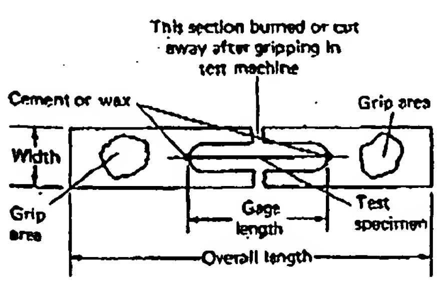

Fig. 26 Schematic showing typical specimen-mounting method for the single-filament fiber tension test (ASTM D 3379)

ASTM D 4018 Method I test specimens require a special cast-resin end tab and grip design to prevent grip slippage under high loads. Alternative methods of specimen mounting to end tabs are acceptable, provided that test specimens maintain axial alignment on the test machine centerline and that they do not slip in the grips at high loads. ASTM D 4018 Method II test specimens require no special gripping mechanisms. Standard rubber-faced jaws should be adequate.

Mechanical Testing of Ceramics

Ceramic materials have been used in a variety of engineering applications that utilize their wear resistance, refractoriness, hardness, and high compression strength. Traditionally, they have not been used in tensile-loaded structures because they are brittle and experience catastrophic failure before permanent deformation. Nevertheless, their extreme refractoriness, chemical inertness, and favorable optical, electrical, and thermal properties are inducements to use ceramics in certain tensile load-bearing applications. Typical mechanical properties of common ceramics are listed in Table 11, and applicable ASTM standards for mechanical testing are listed in Table 12. More current information on mechanical testing of ceramics is provided in Ref 22.

Room-Temperature Strength Tests

Uniaxial Tensile Strength. The nonductile nature of monolithic ceramics and their high sensitivity to stress concentrators has meant that conventional direct tensile testing is difficult and expensive. Gripping with jaws, screw threads, or other conventional devices causes invalid test results because of specimen breakage at the grips. The high stiffness (elastic modulus) of many ceramics means that a misalignment

Table 11 Typical mechanical properties of common ceramic materials

Material	Young's modulus, GPa	Young's modulus, 10^6 psi	Flexural strength, MPa	Flexural strength, ksi	Compressive strength, MPa	Compressive strength, ksi
Brick	5–20	0.7–2.9	5–10	0.7–1.5	10–25	1.5–3.6
Roof tile	5–20	0.7–2.9	8–15	1.2–2.2	10–25	1.5–3.6
Steatite	1–3	0.1–0.4	140–160	20–23	850–1000	123–145
Silica refractories, 96–97% SiO_2	...	...	8–14	1.2–2.0	30–80	4.4–11.6
Fireclay refractories, 10–44% Al_2O_3	20–45	2.9–6.5	5–15	0.7–2.2	10–80	1.5–11.6
Corundum refractories, 75–90% Al_2O_3	30–120	4.4–17.4	10–150	1.5–22	40–200	5.8–30.7
Forsterite refractories	25–30	3.6–4.4	5–10	0.7–1.5	20–40	2.9–5.8
Magnesia refractories	30–35	4.4–5.1	8–200	1.2–29	40–100	5.8–14.5
Zircon refractories	35–40	5.1–5.8	80–200	12–29	30–60	4.4–8.7
Whiteware	10–20	1.5–2.9	20–25	2.9–3.6	30–40	4.4–5.8
Stoneware	30–70	4.4–10.2	20–40	2.9–5.8	40–100	5.8–14.5
Electrical porcelain	55–100	8.0–14.5	90–145	13–21	55–100	8.0–14.5
Capacitor ceramics	...	...	90–160	13–23	300–1000	44–145

Source: Ref 21

of only a few thousandths of a centimeter can lead to bending stresses with errors of 10% or more. Specimen preparation to exacting tolerances with minimal machining damage and careful tapers to avoid stress concentrators has been an expensive proposition. Considerable work has focused on improving tensile test methods for ceramics, with the result that tensile testing is becoming more routine. Commercial equipment is readily available, and specimen costs are falling. It will, however, always be more difficult to conduct direct tensile tests for ceramics than for metals.

The experimental difficulties, coupled with the problems of fabricating sufficiently large specimens, have prompted ceramists to use alternative test methods. The most common is flexure testing, in either the so-called three-point or four-point configuration. The latter is usually further specified by a description of the distance from the outer support points and the inner points, such as ¼ or ⅓ four-point loading. The small size, low cost, and easy preparation of a flexure specimen account for its popularity, but there are distinct drawbacks. The bending creates a stress gradient in the specimen, and only a small volume is exposed to high tensile stress. The specimens are very sensitive to edge or surface machining damage. The test appears easy to set up and conduct, but misalignments and experimental errors can easily ruin it. Standard test methods are now available that permit accurate strength measurements for standard sizes and shapes, as shown in Fig. 27.

Nevertheless, it is still preferable to perform direct tension testing. Current testing systems are designed with self-aligning features that limit the imposed bending stresses to approximately 1%. There is usually less extrapolation of the strength data from test specimen to component size. Tensile specimens are still expensive, however, because of costly fabrication and machining. They are inconveniently large, as well, because most systems are designed for high-temperature test rigs that use cold grips. Until recently, only a few laboratories had the ability to test or to even afford direct tensile experiments. A new emphasis on attaining accurate, quality data in support of ceramics in heat engine programs has led to rapid improvements in the field, and commercial test systems are now readily available. Different tensile specimen geometries that are being used are shown in Fig. 28 (Ref 23–28).

Another occasionally cited test for engineering ceramics is the so-called diametral compression test, or Brazilian disk test, wherein a circular cylinder is loaded at its ends (Ref 29, 30). The test is actually biaxial, because in addition to the tensile stresses that tend to laterally split the specimen, compressive stresses that are three times as great act axially through the specimen. However, compressive stresses of this magnitude are not likely to affect uniaxial strength, an effect peculiar to monolithic ceramics. The specimen loading is between two platens with pads of compliant material (such as a metallic shim or paper) to avoid high shearing stresses. Careful machining of the end faces of the specimen is essential, once again to avoid damage that compromises the test. This point is often overlooked. This test is occasionally employed by ceramics processors for ceramics fabricated in cylindrical shapes.

Many ceramic materials have strengths that are specific to the shaping process being used, such as injection-molded turbocharger rotors or extruded heat-exchanger tubes. In such cases, it is not practical to cut tensile specimens from the part, but separately cast tensile specimens may not have the same microstructure or defects as the component and, therefore, are irrelevant (Ref 31–33). It is optimal to test components in as close a configuration to the final component shape as possible. Thus, in the case of a tube, a ring can be cut from the tube and pressurized to obtain a uniaxial hoop-stress-testing configuration (Ref 34, 35). Contrary to expectations, such a test can be conducted at high temperatures. Indeed, one of the highest recorded strength test temperatures for a ceramic (2180 °C, or 3955 °F) was on a pressurized tube (Ref 36). Extreme care must be taken to ensure that the edges are not chipped and do not have excessive machining damage, lest the test merely become a measure of machining damage.

There is no simple answer to the question of what specimen is best for measuring strength data. The best practice is to test a configuration that most resembles the actual component in its service conditions and to ensure that the test material accurately represents the component material. It is likely that the first available data will be flexure-strength data, which are typically higher (10–50%) than tensile specimen data because of the dependency of strength on test specimen size. Nevertheless, considering the tradeoffs in cost, quantity of results, and difficulty in testing, it is likely that future engineering databases will feature complementary flexure and tensile data. Indeed, it will be beneficial to have strength data from different sizes and shapes to permit an assessment of material consistency, flaw uniformity, and the veracity of strength-size scaling models.

Elastic Modulus. Several methods are used to evaluate the elastic moduli of monolithic or fine-scaled, isotropic composites. The most common are deflection measurements in flexural strength tests (with proper consideration of the test machine compliance) or strain gage experiments in flexure or direct tension. Dynamic measurements are also quite common, with either sonic excitation of prismatic specimens at their resonant frequency or time-of-flight measurements of ultrasonic waves.

Interpretation of Uniaxial Strength. The scatter in uniaxial strengths is well modeled by Weibull statistics. Weibull observed that the strength of brittle materials is controlled by the presence of randomly distributed defects and

Table 12 ASTM standards related to mechanical testing of ceramics

Terminology	
C 1145	Standard Definition of Terms Relating to Advanced Ceramics
C 1286	Standard System for Classification of Advanced Ceramics
Properties and performance (monolithic)	
C 1161	Standard Test Method for Flexural Strength of Advanced Ceramics at Ambient Temperature
C 1211	Standard Test Method for Flexural Strength of Advanced Ceramics at Elevated Temperatures
C 1259	Standard Test Method for Dynamic Young's Modulus
C 1273	Standard Practice for Tensile Strength of Monolithic Advanced Ceramics at Ambient Temperature
Design and evaluation	
C 1175	Standard Guide to Test Methods for Nondestructive Testing of Advanced Ceramics
C 1198	Standard Test Method for Dynamic Young's Modulus
C 1212	Standard Practice for Fabricating Ceramic Reference Specimens Containing Seeded Voids
C 1239	Standard Practice for Reporting Uniaxial Strength Data and Estimating Weibull Distribution Parameters for Advanced Ceramics
Characterization and processing	
C 1251	Standard Guide for Determination of Specific Surface Area of Advanced Ceramics by Gas Adsorption
C 1274	Standard Test Method for Advanced Ceramic Specific Surface Area by Physical Adsorption
C 1282	Standard Test Method for Determination of the Particle Size Distribution of Advanced Ceramics by Centrifugal Photosedimentation
Ceramic composites	
C 1275	Standard Practice for Monotonic Tensile Strength Testing of Continuous Fiber-Reinforced Advanced Ceramics with Solid Rectangular Cross Section at Ambient Temperatures

Source: Ref 21

that failure is controlled by the largest, most severely stressed defect. Fracture occurs when a defect in one particular element of the body reaches a critical loading. This analysis is colloquially known as the weakest-link model, in direct analogy to the strength of a chain.

The Weibull modulus, m, has no units and is the factor that determines the scatter in strength. High values are optimum. Traditional ceramics, such as whitewares and brick, may have values from 3 to 5. A good material has a value that exceeds 10. A ceramic with an m value ≥ 30 has very consistent strengths and could be practically considered to have a deterministic value of strength over a range of several orders of magnitude volume.

Not only does strength scale with specimen size, but the magnitude of the change strongly depends on whether the defects are surface or volume. Obviously, it is essential to know whether flaws are of one or the other category if the laboratory strength data are going to be size-scaled to predict component performance.

A Weibull graph is a convenient means to report strength data. The graph usually has special axes chosen to linearize the data. This is done in the same fashion that probability paper can be used to linearize data for a Gaussian distribution.

The Weibull analysis is adequate for multiaxially, tensilely loaded ceramics, provided that the second or third principal stresses are significantly less than the principal tensile stress. If this is not the case, then it is appropriate to use more sophisticated analyses that take into account the effect of multiaxial tensile stresses on defects. The Weibull analysis also has limitations if the defects are likely to grow subcritically during a test. A newly recognized phenomenon that could occasionally pose problems in strength analysis is *latent* defect caused by localized surface impact or contact stresses. Concentrated microdamage can occur that can lead to a larger microcrack popping in after an incubation period (Ref 37, 38).

Strength values by themselves are only half the picture. The types of defects are equally important because each flaw type has its own Weibull distribution, and because multiple flaw populations are common in ceramics. Therefore, it is essential that the defects be as clearly associated with the strength values as possible.

Uniaxial Compression Strength. The high compressive strength of ceramics is a consequence of the resistance of the material to plastic flow and the insensitivity of defects to compressive stress. Ancient structural applications of ceramics were columns and walls that capitalized on high compressive strength. The fact that ceramics fail at all in compression is a result of the distortion of the stress field in the immediate vicinity of the tip of a defect. This distortion causes a localized tensile stress concentration that, for defects at the worst orientation (~30° to the axial stress) is about ⅛ of the concentration if the specimen is loaded in tension. Thus, a Griffith-type criterion for failure would predict that the compression specimen will fail at about 30° to the specimen axial direction when the compressive stress is eight times the tension strength, but this is an oversimplification.

The tensile stresses in the immediate vicinity of a defect will cause a crack to propagate stably for a slight distance (Ref 39, 40). The crack then aligns itself with the compression stress and is arrested. Progressively more defects grow until the damage that has accumulated in the specimen reaches some limit, and the specimen virulently disintegrates into powder (often with a triboluminescent emission) (Ref 41, 42). Compression strength thus depends not on the largest, worst-oriented, highest-

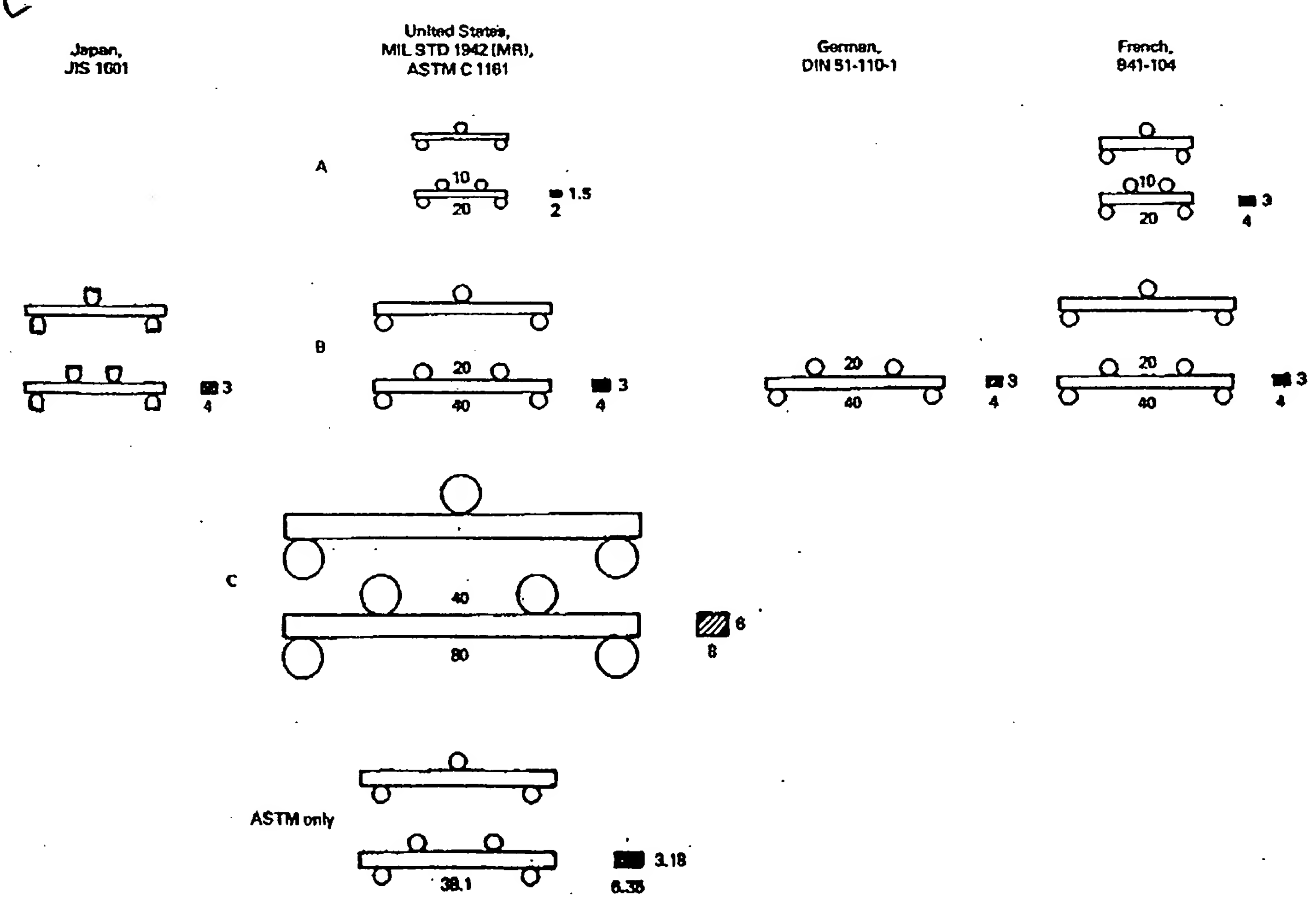

Fig. 27 Flexure strength standard test methods; all dimensions in mm

From: J. S. Goela and M. A. Pickering, "Optics Applications of Chemical Vapor Deposited β-SiC", SPIE Proc. Vol CR67, 71-103 (July 1997)

Exhibit B

attractive because (i) its thermal expansion coefficient matches quite well with that of SiC over a wide range of operating and deposition conditions, (ii) it can be polished to a very smooth surface, and (iii) it can be diamond turned which permits fabrication of aspheric surfaces in a cost effective manner. Cladding of Si on SiC faceplate can be performed either by a CVD[54,55] or evaporation process.

Since SiC is a brittle ceramic material, it is susceptible to the flaw induced fracture. The flaw size, C_f in a brittle material is given by the formula[9]:

$$C_f = 0.79\,(K_{1C}/\sigma)^2$$

where K_{1C} is the fracture toughness, and σ is the strength of the SiC part. Since the fracture toughness of the material is a constant, the strength of the part depends upon the size of the flaw in the material, which in turn depends upon the volume of the material used in the part. Thus larger is the size of the part, the higher is the probability of finding a flaw of larger size. For SiC with $K_{1C} = 3.4\ MNm^{-1.5}$, and $\sigma = 421$ MPa, the flaw size is about 52 μm which is quite small and is a few times the grain size of the material. The maximum allowable stress, σ in large parts can be calculated from the following formula:

$$\sigma = \cancel{\sigma_1(A_1/A)^{1/m}}\quad \sigma_1\left(A_1/A\right)^{1/m}$$

where σ_1 is the mean fracture stress for the test specimens, A is the area of the large part, A_1 is the area of the test specimen and m is the Weibull modulus. For SiC, m = 11.45, σ_1 = 421 MPa, A = 160 mm². Consequently, for a 1-m diameter part, the allowable maximum stress in the part is 200 MPa. For as-grown SiC surfaces however, the value of m was determined to be about 4 with σ_1 = 262 MPa[56]. In this case the allowable maximum stress in the 1-m diameter part is only about 31 MPa which is quite small. These calculations indicate that while fabricating large size mirrors by the CVD process, one should take extra care to ensure that the SiC deposit is not stressed beyond the allowable values during furnace cool-down.

Precision Replication: Precision replication is used when a large number of identical mirrors of CVD-SiC are required[57-59]. Since in the CVD process, SiC is deposited on the mandrel atom by atom, it is possible to replicate a surface down to the atomic scale. Precision replication is performed by depositing SiC on highly polished mandrels. The candidate mandrel materials are SiC, graphite, sapphire, molybdenum and tungsten[57]. The latter three mandrel materials have thermal expansion coefficient larger than that of SiC. The thermal expansion coefficient of graphite depends upon its grade. Consequently, graphite, sapphire, Mo and W can be used for replicating concave or female parts. For replicating convex or male parts, SiC and graphite are the two preferred mandrel materials. Since graphite cannot be polished to a very smooth surface, it can be clad with a layer of SiC or SiO_2 and the optical surface can be fabricated in the clad layer. Since SiC adheres to SiC, a release coating is required to separate the mandrel from the deposit. Sapphire does not require a release coating and readily separates from the SiC deposit due to a significant thermal expansion mismatch. The other two mandrel materials, Mo and W gets etched in the CVD-SiC process due to the

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In re Rose

Court of Customs and Patent Appeals

Appl. No. 6080

Decided Mar. 22, 1955

United States Patents Quarterly Headnotes

PATENTS
[1] Patentability - Change - Size or strength (§ 51.261)
Size of article ordinarily is not matter of invention.

PATENTS
[2] Court of Customs and Patent Appeals - Issues determined - Ex parte patent cases (§ 28.203)
Since one rejection must be sustained, it is unnecessary for court to discuss another rejection.

PATENTS
[3] Patentability-In general (§ 51.01)
Feature upon which applicant predicates patentability must not only be disclosed in specification but also brought out or recited in claims.

PATENTS
[4] Patentability-In general (§ 51.01)
Patentability-Invention-In general (§ 51.501)
Novel concept, per se, is not conclusive of invention; everything which is novel is not patentable, because, in addition to being novel and useful, device must involve invention.

PATENTS
[5] Patentability-Aggregation or combination-Of old elements (§ 51.159)
There is no invention involved in combining old elements in such a manner that these elements perform in combination the same function as set forth in prior art without giving unobvious and unexpected result.

PATENTS
[6] Patentability-Evidence of-Commercial success-Doubtful cases (§ 51.4557)
Where there is doubt as to whether invention exists, extensive use and commercial success may be considered to resolve question in favor of applicant; however, evidence of commercial success may be controlling only where issue of patentability is otherwise doubtful.

PATENTS
Particular patents-Lumber Package
Rose, Package of, Apparatus for Packaging and Method of Handling and Storing Lumber, claims 29 to 33 of application refused.

*238 Appeal from Board of Appeals of the Patent Office.

Application for patent of Daniel Morton Rose, application, Serial No. 190,625; Patent Office Division 40. From decision rejecting claims 29 to 33, applicant appeals. Affirmed.

J. Preston Swecker (William L. Mathis of counsel) both of Washington, D.C., for appellant.

E. L. Reynolds (H. S. Miller of counsel) for Commissioner of Patents.

Before Garrett, Chief Judge, and O'Connell, Johnson, Worley and Cole, Associate Judges.

Johnson, Judge.

This is an appeal from the decision of the Board of Appeals of the United States Patent Office affirming the holding of the Primary Examiner rejecting as unpatentable claims 29 to 33, the only remaining claims in appellants application for a patent on a "Package of, Apparatus for Packaging and Method of

Handling and Storing Lumber."

The appealed claims relate to a lumber package which is composed of individually banded bundles of lumber which vary in length. Each individual bundle of lumber consists of layers of strips of lumber which are approximately the same length. Each layer consists of a plurality of strips of lumber. These individually banded bundles, which vary in length, are arranged in superposed relationship so that the longer bundles form the base of a stacked arrangement of bundles, and the shorter bundles rest on the longer bundles and on each other. The bundles are arranged in layers of uniform width and depth with a plurality of bundles in each layer. The topmost of the stacked arrangement may be long bundles or short bundles. The stack of bundles thus formed is secured with a plurality of bands, which extend transversely to the length dimension of the bundles. These bands bind said bundles together and form a package. Some of the claims recite the presence of runners beneath the package. These runners extend transversely to the length of the package and are held to the package by the aforementioned bands which bind the package. The runners serve the purpose of supporting the package in elevated position above the surface upon which it rests.

Claims 29, 30, and 31, which are representative of the appealed claims, read as follows:

> 29. As an article of manufacture, a lumber package comprising a plurality of bundles, each bundle including a plurality of strips of lumber, a band encircling the strips of each bundle, the plurality of bundles being arranged in superposed relation, and a plurality of bands encircling the plurality of bundles and spaced apart lengthwise of the strips, at least one of the bundles at the bottom portion of the package and another of the bundles adjacent the top of the package each having the strips thereof extending throughout the length of the package between a plurality of the last-mentioned bands, and at least some of the bundles between said long-strip bundles being spaced apart lengthwise of the package within the respective bands thereof and comprising short strips appreciably shorter than said long strips.

> 30. As an article of manufacture, a lumber package comprising a plurality of bundles of uniform width and depth, each bundle including a plurality of layers of strips of lumber, each layer comprising a plurality of strips lying side by side, a band encircing [sic] the strips of each bundle, the plurality of bundles being arranged in superposed relation, and a plurality of bands encircling the plurality of bundles and spaced apart lengthwise of the strips, at least one of the bundles at the bottom portion of the package and another of the bundles adjacent the top of the package each having the strips thereof extending throughout the length of the package between a plurality of the last-mentioned bands, and runners beneath the package extending transversely thereof between ***239** the last-mentioned bands and the lowermost bundles supporting the latter in elevated position.

> 31. As an article of manufacture, a lumber package comprising bundles, each bundle including a plurality of layers of strips of lumber, each layer comprising a plurality of strips lying side by side, a band encircling the strips of each bundle, said bundles being arranged in a multiplicity of layers with more than two bundles in each layer lying side-by-side in edge-to-edge relation, and each of a plurality of the layers having the bundles thereof spaced apart lengthwise thereof in end-to-end relation, and a plurality of bands encircling said bundles and spaced apart lengthwise of the strips, a plurality of the bundles at the bottom portion of the package each having the strips thereof extending throughout the length of the package between a plurality of the last-mentioned bands, and runners beneath the package extending transversely thereof between the last-mentioned bands and the lowermost bundles supporting the latter in elevated positions, the strips of each bundle being of appreciable width and thickness and each bundle being of appreciable length cooperating in the multiplicity of bundles to provide a composite package of appreciable size and weight requiring handling by a lift truck.

The references relied on by the Patent Office are:

Denison, 1,600,720, Sept. 21, 1926.

Wheless, 1,766,317, June 24, 1930.

Chambers, 2,012,220, Aug. 20, 1935.

Owens, 2,287,056, June 23, 1942.

Ott, 2,328,356, Aug. 31, 1943.

The Denison patent discloses a lumber package

which consists of layers of wood which are bound transversely to their length by bands formed of metal. Each layer consists of a plurality of strips of lumber. The following portion of the Denison specification is deemed to adequately describe the structure of the Denison lumber package:

> * * * One or more of the lower layers and of the upper layers are preferably formed of pieces which are of the full length of the package. The intermediate layers are made of pieces of full length or of any length which will produce the full length of the package, pieces being selected which will, when laid in position end to end, make the full length or eight feet. Thus two pieces or several pieces may be placed end to end to make the full length. This is the preferred way. But spaces may be left between the ends of the short pieces. That will require more layers to give the package the chosen number of lineal feet of boards.

The Wheless patent discloses a package for knocked down window screen frames. Some of the knocked down pieces of a window screen frame are of different length from other pieces. All of the pieces having one length are wrapped in one bundle. The pieces having another length are wrapped in another bundle. These two bundles are then encircled by strips of paper which hold the individual packages together.

The Chambers patent discloses a method for storing and dispensing lumber. The portion of this patent which is pertinent to the present case shows layers of strips of lumber of equal length fastened by cleats or binder bands to form a plurality of bundles. Each layer consists of a plurality of strips. The bundles are stacked on top of each other. A plurality of bundles in stacked relationship are capable of being handled by a crane.

The Owens patent relates to the packaging of steel sheet material. The portion of this patent which is pertinent to the patent application before us discloses sheets of metal of equal length stacked on a plurality of spaced blocks which are positioned with their longitudinal axes extending transversely to the length of of the sheets. Steel bands encircle both the blocks and sheets to form a bundle. A plurality of bundles formed in this manner are stacked on top of each other and fastened together by means of two bands to form a package. One of the last mentioned bands encircles the package in a transverse direction, and the other in a longitudinal direction.

The Ott patent also discloses a package of strip metal. The package consists of a plurality of individually bound bundles of sheets of equal length fastened together by means of steel bands wrapped transversely around the plurality of individually bound bundles of sheets to form a package. Interposed between the aforementioned steel bands and said plurality of bundles, on the upper and lower surfaces of the package, are a number of wooden cleats or blocks which extend transversely of said bundles.

The application involved in this appeal has been before the Board of Appeals of the Patent Office twice. In the first appeal, the Board of Appeals rendered a decision on February 27, 1953, in which it affirmed the decision of the Primary Examiner in which he rejected claims 18 through 30, 32 and 33. Claim 31, prior to the decision of the Board of Appeals, had been allowed by the Primary Examiner in a different form from which it appears above. However, the ***240** Board of Appeals rejected claim 31 under the provisions of Patent Office Rule 196(b) [FN1] on the ground that it did not patentably differentiate from another of the rejected claims. The application was then remanded to the Primary Examiner. Claim 31 was amended by applicant, placed in the condition in which it appears above, and was subsequently rejected by the Primary Examiner. The appellant then appealed to the Board of Appeals from the rejection of claim 31, as amended, and also requested that the board reconsider its previous decision relative to the affirmance of the examiner's rejection of claims 29, 30, 32, and 33. The Board of Appeals rendered its second decision on July 21, 1953, in which it affirmed the Primary Examiner's rejection of claim 31. The board also reviewed its previous decision which pertained to claims 29, 30, 32, and 33, but stated that it could find no reasons for changing or modifying its previous decision. Thus claims 29 through 33 are before us because of an adverse decision on patentability by the Board of Appeals.

The Board of Appeals affirmed the examiner's rejections of claim 31 on (1) Denison in view of Wheless, Ott, Chambers, and Owens, and (2) on Denison in view of Wheless and Ott. The substance of the second of the above rejections is best stated by quoting directly from the board's decision as follows:

> * * * It would not be invention to separate the random length lumber strips of Denison into bundles of approximately equal length with each

> bundle tied separately and all the bundles tied together in a package after the teaching of Wheless. Nor would it be invention to provide transverse runners on the package of Denison after the teaching of Ott. It is noted that Denison teaches that 'one or more' of the upper and lower layers may be formed of pieces which are the full length of the package (see specification, page 1, lines 87-99) and it would not be invention to form these full length layers as separate bundles, if desired. The number of strips in a bundle, the number of bundles in a layer, the number of layers of bundles and the relative dimensions of the strips, the bundles and the package are all deemed matters of choice involving differences in degree and/or size and [are] not patentable distinctions, * * *

Appellant argues that this claim recites that the package is of appreciable size and weight so as to require handling by a lift truck whereas Wheless and Denison packages can be lifted by hand. We do not feel that this limitation is patent-

[1] ably significant since it at most relates to the size of the article under consideration which is not ordinarily a matter of invention. In re Yount, 36 C.C.P.A. (Patents) 775, 171 F.2d 317, 80 USPQ 141. Notwithstanding appellant's arguments, we feel that this sec-

[2] ond rejection is sound. Since the second rejection must be sustained, we deem it unnecessary to discuss the first of said above rejections. In re Hall, 41 C.C.P.A. (Patents) 759, 208 F.2d 370, 100 USPQ 46.

The examiner's rejection of claim 29, which was affirmed by the board, is that it *stands rejected on Denison in view of Wheless.* Since the reasoning behind this rejection is similar to the reasoning of the rejection of claim 31, as stated above, we do not feel that it is necessary to repeat the rejection here. We agree with the board's holding.

The examiner rejected claims 30, 32, and 33 on Chambers in view of Owens and on Owens in view of Chambers with the addition of Ott; the board affirmed this rejection. These three claims are substantially similar in scope, and claim 30, supra, is considered representative of this group. The substance of the rejection is that it would not be invention to join a plurality of the bundles of Chambers into a package by means of one or more transverse tie bands, after the teaching of Owens, and it would not be invention to omit the intermediate runners of Owens or Chambers and their function, if desired, and to secure the bottom runners separately to the package ***241** by means of the package tie bands after the teaching of Ott. It is to be noted that the Chambers and Owens patents disclose packages which contain bundles of strips of material of equal length, as described above. Appellant states that his package consists of bundles of shorter and longer length. However, it can readily be seen that claim 30 (which is representative of the group consisting of claims 30, 32, and 33) does not recite that some of the bundles are of shorter length than other bundles. We feel that these claims are not patentable

[3] over the applied references since the particular feature upon which an applicant predicates patentability must not only be disclosed in the specification but also brought out or recited in the claims. In re Richards, 38 C.C.P.A. (Patents) 900, 187 F.2d 643, 89 USPQ 64. It is to be noted further that claim 30 recites "a lumber package comprising a plurality of bundles of uniform width and depth, each bundle including a plurality of layers of strips of lumber, each layer comprising a plurality of strips side by side." The chambers patent discloses this structure. We are therefore in agreement with the Board of Appeals on their holding relative to claims 30, 32, and 33.

Appellant makes many arguments that his claims are patentable. These arguments in essence are:

> (1) The patent application discloses a novel concept which is not taught by the prior art; therefore, the claims should be deemed patentable notwithstanding the simplicity of the structure.
>
> (2) Since there has been commercial success, trade adoption, and imitation of the instant lumber package, as evidenced by an affidavit submitted during the prosecution of the application before the Patent Office, the claims should not be rejected in the absence of clear proof that they are anticipated or clearly invalid.

[4] Relative to appellant's first argument, we do not feel that a novel concept, per se, is conclusive of invention. It is quite evident that everything which is novel must be based on a novel concept. However, it is well settled that everything which is novel is not patentable, because, in addition to being novel and useful, the device sought to be patented must involve invention. In re Corbett, 31

C.C.P.A. (Patents) 1077, 142 F.2d 78, 61 USPQ 361. In re Green, 25 C.C.P.A. (Patents) 1143, 97 F.2d 130, 37 USPQ 690. Thus appellant's argument that he has presented a novel concept is not persuasive as to the patentability of his claims since, in our opinion,

[5] there is no invention involved in combining, in appellant's structure, the various known elements and features of the cited prior art in such a manner that these elements and features perform in combination the same function as set forth in said prior art without giving an unobvious and unexpected result. In re Lindberg, 39 C.C.P.A. (Patents) 866, 194 F.2d 732, 93 USPQ 23.

[6] We now come to appellant's second argument, which relates to the commercial success of his lumber package, as evidenced by the aforementioned affidavit. It is well settled that where there is a *doubt* as to whether invention exists in an item sought to be patented that extensive use and commercial success may be considered to resolve the question of patentability in favor of the applicant for a patent. In re Hock, 35 C.C.P.A. (Patents) 1235, 168 F.2d 540, 78 USPQ 75. However, it is equally well settled that evidence of commercial success may be controlling only where the issue of patentability is otherwise doubtful. In re Renstrom, 36 C.C.P.A. (Patents) 1020, 174 F.2d 140, 81 USPQ 390. In re Gillette, 36 C.C.P.A. (Patents) 1172, 175 F.2d 787, 82 USPQ 196. In the present case, we feel that there is no doubt that invention is lacking. Therefore, we feel that the arguments relative to commercial success are not persuasive toward allowance of the claims.

It is to be noted in this respect, however, that appellant points out that there was a conflict to opinion in the Patent Office relative to the allowability of claim 31, as discussed above. It would seem that any doubt as to the allowability of claim 31 was solely on the part of the examiner, but this doubt was resolved overwhelmingly against patentability by the Board of Appeals. We have no doubt that claim 31 does not contain patentable subject matter, and we therefore consider the commercial success of the lumber package under consideration to be immaterial with respect to patentability.

For reasons hereinbefore stated, the decision of the Board of Appeals is *affirmed*.

FN1 Rule 196(b) Should the Board of Appeals have knowledge of any grounds not involved in the appeal for rejecting any claim, it may include in its decision a statement to that effect with its reasons for so holding, which statement shall constitute a rejection of the claims. The appellant may submit an appropriate amendment of the claims so rejected or a showing of facts, or both, and have the matter reconsidered by the primary examiner. The statement shall be binding upon the primary examiner unless an amendment or showing of facts not previously of record be made which, in the opinion of the primary examiner, avoids the additional ground for rejection stated in the decision. The applicant may waive such reconsideration before the primary examiner and have the case reconsidered by the Board of Appeals upon the same record before them. Where request for such reconsideration is made the Board of Appeals shall, if necessary, render a new decision which shall include all grounds upon which a patent is refused. The applicant may waive reconsideration by the Board of Appeals and treat the decision, including the added grounds for rejection given by the Board of Appeals, as a final decision in the case.

Cust. & Pat.App.

105 U.S.P.Q. 237

END OF DOCUMENT

X. RELATED PROCEEDINGS APPENDIX

To the knowledge of the undersigned, there are no decisions rendered by a court or the Board in any proceeding identified pursuant to paragraph (c)(1)(ii) of 37 CFR §41.37.